

IN THE CLAIMS:

The text of all pending claims, (including withdrawn claims) is set forth below. Cancelled and not entered claims are indicated with claim number and status only. The claims as listed below show added text with underlining and deleted text with ~~strike through~~. The status of each claim is indicated with one of (original), (currently amended), (cancelled), (withdrawn), (new), (previously presented), or (not entered).

1. (Previously Presented) A constant velocity universal joint, comprising:

an outer race having a substantially spherical inner surface, said substantially spherical inner surface having a plurality of track grooves defined therein, each of said track grooves in the outer race having a groove bottom of a longitudinal sectional shape representing a shape of a curve;

an inner race having a substantially spherical outer surface and positioned inside the outer race, said substantially spherical outer surface having a plurality of track grooves defined therein in correspondence with the respective track grooves in the outer race, each of said track grooves in the inner race having a groove bottom of a longitudinal sectional shape representing a shape of a curve;

a plurality of balls interposed between the outer and inner races and rotatably accommodated between the mating track grooves in the outer and inner races;

a retainer having a plurality of pockets accommodating therein the corresponding balls, said retainer having a substantially spherical outer surface, held in surface contact with the substantially spherical inner surface of the outer race, and a substantially spherical inner surface held in surface contact with the substantially spherical outer surface of the inner race;

each of said track grooves in the outer race having a center of curvature lying in an axial section of the outer race;

each of said track grooves in the inner race having a center of curvature lying on an axial section of the inner race, said center of curvature of each track groove in the outer race and said center of curvature of each track groove in the inner race being offset an equal distance leftwardly and rightwardly with respect to an angle center of the universal joint;

at least one of said substantially spherical inner surface of the outer race or each of the track grooves in the outer race being defined by a post-hardening cut surface;

the outer race being made of a medium carbon steel; and

each post-hardening cut surface having a surface roughness not greater than 0.8 as stipulated in B0601 of JIS standards.

2. (Previously Presented) The constant velocity universal joint as claimed in Claim 1, wherein:

at least one of said substantially spherical outer surface of the inner race or each of the track grooves in the inner race is defined by a post-hardening cut surface;

the inner race is made of a case hardening steel; and

each post-hardening cut surface has a surface roughness not greater than 0.8 as stipulated in B0601 of the JIS standards.

3. (Previously Presented) The constant velocity universal joint as claimed in Claim 1, wherein

of the substantially spherical outer surface, the substantially spherical inner surface, and the pockets, at least the pockets have respective inner surfaces which are defined by a post-hardening cut surface;

the retainer is made of a case hardening steel; and

each post-hardening cut surface has a surface roughness not greater than 0.8 as stipulated in B0601 of the JIS standards.

4. (Original) The constant velocity universal joint as claimed in Claim 1, wherein the constant velocity universal joint is for use with a propeller shaft.

5. (Previously Presented) The constant velocity universal joint as claimed in Claim 4, wherein the outer race has an inlet mouth and a rear opening opposite to the inlet mouth and having a diameter smaller than a diameter of the inlet mouth, said outer race also having a fitting flange formed therewith at a location radially outwardly of an outer periphery of the inlet mouth and a cylindrical mount formed therewith to protrude axially outwardly from the opening, wherein the propeller shaft extends through the rear opening and is then engaged with the inner peripheral surface of the inner race.

6. (Original) The constant velocity universal joint as claimed in Claim 1, wherein the number of the track grooves in each of the inner and outer races is eight.

7. (Previously Presented) The constant velocity universal joint as claimed in Claim 1, wherein a surface of at least the retainer is formed with a surface treatment layer to reduce a frictional resistance.

8. (Original) The constant velocity universal joint as claimed in Claim 7, wherein the surface treatment layer is a film of a solid lubricant.

9. (Original) The constant velocity universal joint as claimed in Claim 7, wherein the surface treatment layer is a low temperature sulfurized layer.

10. (Original) The constant velocity universal joint as claimed in Claim 1, wherein each of the track grooves in each of the inner and outer races and the corresponding ball cooperate to define radial gaps therebetween, each of said radial gap being of a size not greater than 0.05 mm.

11. (Original) The constant velocity universal joint as claimed in Claim 1, wherein each of the pockets in the retainer and the corresponding ball accommodated therein cooperate to define axial gaps, each of said axial gaps being positive.

12. (Original) The constant velocity universal joint as claimed in Claim 1, wherein each of the track grooves in the outer race has a transverse sectional shape that is oval.

13. (Previously Presented) The constant velocity universal joint according to claim 1, wherein the spherical inner surface of the outer race has a surface roughness not greater than 0.8, as stipulated in B0601 of the JIS standards.

14. (Previously Presented) The constant velocity universal joint according to claim 8, further comprising:

an undercoat provided between the surface of the retainer and the solid lubricant.

15. (Previously Presented) The constant velocity universal joint according to claim 14, wherein the undercoat is made of manganese phosphate.

16. (Previously Presented) A constant velocity universal joint, comprising:

an outer race having a spherical inner surface, said spherical inner surface having a plurality of track grooves defined therein, each of said track grooves in the outer race having a groove bottom of a longitudinal sectional shape representing a shape of a curve;

an inner race having a spherical outer surface and positioned inside the outer race, said spherical outer surface having a plurality of track grooves defined therein in correspondence with the respective track grooves in the outer race, each of said track grooves in the inner race

having a groove bottom of a longitudinal sectional shape representing a shape of a curve;

a plurality of balls interposed between the outer and inner races and rotatably accommodated between the mating track grooves in the outer and inner races;

a retainer having a plurality of pockets accommodating therein the corresponding balls, said retainer having a spherical outer surface, held in surface contact with the spherical inner surface of the outer race, and a spherical inner surface held in surface contact with the spherical outer surface of the inner race;

each of said track grooves in the outer race having a center of curvature lying in an axial section of the outer race; and

each of said track grooves in the inner race having a center of curvature lying on an axial section of the inner race, said center of curvature of each track groove in the outer race and said center of curvature of each track groove in the inner race being offset an equal distance leftwardly and rightwardly with respect to an angle center of the universal joint;

at least one of said spherical inner surface of the outer race or each of the track grooves in the outer race being defined by a post-hardening cut surface,

a surface of at least the retainer being formed with a surface treatment layer to reduce a frictional resistance, and

a surface treatment layer formed in the inner and outer races is different than the surface treatment layer formed in the surface of the retainer.

17. (Previously Presented) The constant velocity universal joint according to claim 3, wherein a surface of at least the retainer is formed with a surface treatment layer for reducing a frictional resistance,

wherein the surface treatment layer is a film of a solid lubricant, and

further comprising an undercoat provided between the surface of the retainer and the solid lubricant.

18. (Previously Presented) The constant velocity universal joint according to claim 3, wherein a surface of at least the retainer is formed with a surface treatment layer for reducing a frictional resistance, and

wherein a surface treatment layer formed in the inner and outer races is different than the surface treatment layer formed in the surface of the retainer.

19. (Previously Presented) The constant velocity universal joint according to claim 5, wherein a surface of at least the retainer is formed with a surface treatment layer to reduce a frictional resistance,

wherein the surface treatment layer is a film of a solid lubricant, and  
further comprising an undercoat provided between the surface of the retainer and the solid lubricant.

20. (Previously Presented) The constant velocity universal joint according to claim 5, wherein a surface of at least the retainer is formed with a surface treatment layer to reduce a frictional resistance, and

wherein a surface treatment layer formed in the inner and outer races is different than the surface treatment layer formed in the surface of the retainer.

21. (Withdrawn) A method of manufacturing a constant velocity universal joint, comprising:

forging an outer race member;

forging an inner race member;

pressing a retainer member;

hardening the outer race member, the inner race member, and the retainer member with a heat treatment; and

after the hardening, cutting at least one of an inner surface of the outer race member to form a substantially spherical inner surface, or a plurality of track grooves in the inner surface of the outer race member, each post-hardening cut surface having a surface roughness not greater than 0.8 as stipulated in B0601 of JIS standards,

wherein the outer race member is made of a medium carbon steel, and

each of the track grooves in the outer race has

a groove bottom of a longitudinal sectional shape representing a shape of a curve, and

a center of curvature lying in an axial section of the outer race.

22. (Withdrawn) The method according to claim 21, further comprising:

after the hardening, cutting at least one of an outer surface of the inner race member to form a substantially spherical outer surface, or a plurality of track grooves in the outer surface of the inner race member defined in correspondence with the respective track grooves in the outer race, each post-hardening cut surface having a surface roughness not greater than 0.8 as stipulated in B0601 of JIS standards,

wherein the inner race member is made of a case hardening steel,

each of the track grooves in the inner race has

a groove bottom of a longitudinal sectional shape representing a shape of a curve, and

a center of curvature lying on an axial section of the inner race, and

the center of curvature of each track groove in the outer race and the center of curvature of each track groove in the inner race being offset an equal distance leftwardly and rightwardly with respect to an angle center of the universal joint.

23. (Withdrawn) The method according to claim 21, further comprising:

after the hardening, cutting at least one of a substantially spherical outer surface of the retainer member, a substantially spherical inner surface of the retainer member, or inner surfaces of a plurality of pockets in the retainer member, each post-hardening cut surface having a surface roughness not greater than 0.8 as stipulated in B0601 of JIS standards,

wherein the retainer is made of a case hardening steel.